

Claims

1. A water softener to produce soft water at various temperatures and facilitate regeneration of an ion exchange resin (112) thereof by causing raw water to pass through the ion exchange resin (112) to produce soft water during a soft water producing process and causing a regeneration material (132) to be dissolved in the raw water to generate regeneration water that then flows through the ion exchange resin (112) to regenerate the ion exchange resin, and is, thereafter, discharged as resulting waste regeneration water during a regeneration process, wherein the water softener (100) comprises:

a water softening tank (110) in which an internal region containing therein the ion exchange resin (112) is partitioned into a plurality of water softening regions (110a, 110b, 110c and 110d), which are individually assigned into a predetermined temperature, with a raw water feed pipe (114) placed in a longitudinal direction of the water softening tank, a plurality of partitions (115) placed in radial directions around the raw water feed pipe (114), a water inlet hole (116) formed on a bottom of the water softening tank to extend the water transport tube (114) to the exterior and supply the raw water into the water softening tank, and a plurality of water discharge holes (118) formed on the bottom of the water softening

tank to allow for a communication of the plurality of water softening regions with the exterior and to discharge the soft water and the waste regeneration water to the exterior;

5 a regeneration tank (130) coupled to an upper part of the water softening tank (110) and containing therein the regeneration material (132);

10 a cold/hot control valve (140) provided on an upper part of the raw water feed pipe (114) in a form of being inserted into the regeneration tank (130) to supply the raw water to a selected one of the plurality of water softening regions (110a, 110b, 110c and 110d) during the soft water producing process;

15 a regeneration valve (160) penetrating an upper surface of the regeneration tank (130) and coupled to the raw water feed pipe (114) through the cold/hot control valve (140), and, upon regeneration of the ion exchange resin, introducing the raw water into the regeneration tank (130) by manual control to produce the regeneration water 20 and then supplying the regeneration water to a selected one of the plurality of water softening regions (110a, 110b, 110c and 110d);

25 a temperature sensor (190) to sense a temperature of the raw water supplied through the water inlet hole (116); and

an operation control unit (200) to control the

cold/hot control valve (140) to supply the raw water to one of the plurality of water softening regions (110a, 110b, 110c and 110d) according to the temperature of the raw water sensed by the temperature sensor (190).

5           2. The water softener to produce the soft water at various temperatures and facilitate the regeneration of the ion exchange resin according to claim 1, wherein the cold/hot control valve (140) comprises:

10           a control valve housing (142) having a pipe shape to substantially widen the upper part of the raw water feed pipe (114) of the water softening tank (110), and comprising a plurality of vertical pairs of holes each including a regeneration water hole (144) and a raw water hole (146) that are formed through an outer surface of the 15 control valve housing to communicate the raw water feed pipe (114) with each of the plurality of water softening regions (110a, 110b, 110c and 110d); and

20           a rotatory body (152) having a pipe shape of which a lower part is inserted into the control valve housing (142) and an upper part is inserted into the regeneration tank (130), with both a regeneration water guide hole (154) and a raw water guide hole (156) formed through an outer surface of the lower part of the rotatory body to communicate respectively with the regeneration water hole 25 (144) and the raw water hole (146) of a selected pair of

holes by a rotation of the rotatory body (152), and a plurality of regeneration water supply holes (158) formed around an outer surface of the upper part of the rotary body near a bottom of the regeneration tank (130),

5 wherein, the regeneration valve (160) comprises:

a tube housing (162) having a tubular shape to be coupled to the rotatory body (152), with a regeneration raw water hole (164) formed through an outer surface of the tube housing placed in the regeneration tank (130); and

10 a stem shaft (172) having a tubular shape with a closed-upper end, and inserted into both the tube housing (162) and the rotatory body (152) to move upward and downward, with a regeneration raw water guide hole (174) formed through an outer surface of the stem shaft, the stem shaft thus closing the regeneration water guide hole (154) and simultaneously opening the raw water guide hole (156) at a lower end thereof when moving upward, and, when moving downward, the stem shaft communicating the regeneration raw water guide hole (174) with the regeneration raw water hole (164), and simultaneously communicating the regeneration water supply hole (158) with the regeneration water guide hole (154) through an internal region of the rotatory body (152), and closing the raw water guide hole (156) at the lower end thereof.

25 3. The water softener to produce the soft water at

various temperatures and facilitate the regeneration of the ion exchange resin according to claim 2, wherein the operation control unit (200) comprises:

5 a motor (202) to rotate an upper part of the tube housing (162) exposed to an outside of the upper part of the regeneration tank (130) to rotate the rotatory body (152): and

10 a logic operation unit to determine a rotational direction and a rotational angle of the motor (202) according to a sensing result of the temperature sensor (190).

4. The water softener to produce the soft water at various temperatures and facilitate the regeneration of the ion exchange resin according to claim 3, further comprising:

a locking protrusion (178) provided on the outer surface of the stem shaft (172) exposed to an outside of an upper end of the tube housing (162); and

20 a ring-shaped control unit (210) coupled to the upper end of the tube housing (162) while surrounding both the locking protrusion (178) and the stem shaft (172), with a first locking groove (212) and a second locking groove (214) respectively provided on an upper part and a lower part of an outer surface of the ring-shaped control unit to 25 limit uppermost and lowermost positions of the stem shaft

(172), and a connection groove (216) to connect corresponding ends of the first and second locking grooves to each other, thus allowing a user to manually move vertically and lock the upper end of the stem shaft (172).

5        5. The water softener to produce the soft water at various temperatures and facilitate the regeneration of the ion exchange resin according to claim 1, wherein the regeneration tank (110) and the water softening tank (130) coupled to each other in a vertical direction individually 10 comprise a plurality of tanks arranged side by side, and further comprising:

15        a base frame (180) to surround lower ends of the plurality of water softening tanks (130) defining an internal water discharge region (184) to which the plurality of water discharge holes (118) of the water softening tanks (130) join together, with a water inlet tube (182) to supply the external raw water to the lower frame and a water discharge tube (186) to extend the water discharge region (184) to an exterior;

20        a raw water control valve (188) provided on the base frame (180) and manually controlled by a user to supply the raw water from the water inflow tube (182) to a selected one of the water inlet holes (116) of the plurality of water softening tanks (130); and

25        a preprocessing filter (192) installed in the base

frame (180) to be placed between each of the plurality of water inlet holes (118) and the water inlet tube (182), thus removing impurities from the raw water.